

**DEVICES FOR STORAGE BETWEEN CEILING JOISTS,
WHICH ACCOMMODATE FOR JOIST SPACING VARIATIONS**

FIELD OF THE INVENTION

This invention is in the field of mechanical devices and storage containers, and relates to storage boxes or trays that can be suspended between joists, such as in the ceiling of a basement.

BACKGROUND OF THE INVENTION

In any building, and particularly in small to moderate-sized homes, there is a trade-off between space for working and living, and space for storage. Closets, cupboards, and many types of cabinets directly decrease the amount of floor space that is available in the rooms of a home, and furniture-type storage devices (such as dressers, chests of drawers, armoires, etc.) also occupy floor space. Even shelves that are mounted on a wall or suspended from a ceiling must occupy space that could otherwise give a room a more spacious and uncluttered appearance and feel.

To try to help homeowners deal with these problems, many people have created storage devices that attempt to use space, within a home, that otherwise would be regarded as generally unusable. In particular, at least a dozen inventors have disclosed and patented various attempts to create storage boxes that can be installed between joists, in a basement ceiling. Examples include US patents 4,699,437 (Genereaux 1987), 5,039,902 (Schwarz 1991), and 5,649,751 (Longhurst 1997). For reasons described below, none of those proposed storage devices are commercially available today.

The term *joist* is used herein in the conventional sense that is familiar to any carpenter. It refers to the relatively large boards or beams, made of wood or alternate building materials that function as wood substitutes, that support the weight of a floor. Typical wooden joists are made of "2 by 8" (also expressed as 2x8) or "2 by 10" (2x10) pieces of lumber. These dimensions refer

to "nominal" thicknesses and widths, in inches (actual dimensions are usually somewhat smaller, such as 1.5 inch instead of 2 inch thicknesses). In some homes (especially in countries outside the United States), joists are sometimes made of smaller pieces, such as 2 by 6 lumber.

As used herein, "joists" is limited to accessible joists, such as the layer of joists that helps to define and occupy the ceiling of a basement while also supporting a floor structure that rests on top of the joists. Because of their positioning, joists are commonly referred to as either ceiling joists, or floor joists (typically depending on which level the person is standing on, when referring to the joists). To minimize the risk of confusion, and to also include joists that are accessible above a "crawl space" beneath a house (or in another comparable space), the term "building joist" can also be used.

As used herein, the *thickness* of a joist refers to its minimum cross-sectional dimension. Accordingly, joists made of 2x6, 2x8, or 2x10 lumber will have nominal thicknesses of 2 inches, and typically will have actual thicknesses of about 1.5 inches.

The other cross-sectional dimension can be referred to as either width, or height, since joists are conventionally placed in an orientation that causes their width (i.e., their longest cross-sectional dimension) to be vertical. This is illustrated in FIG. 1, in which 2x8 joists designated by callout numbers 82 and 84 have their 8-inch width (or height) in the vertical direction, while their 2-inch thickness is in the horizontal direction. This type of vertical orientation is used, because it provides stronger and more solid support for the floor that rests on top of the joists. Among other advantages, this arrangement will minimize deflections and motions by the floor when people walk across it; higher levels of deflection would cause more stress, as well as louder creaking noises and other unwanted effects.

The thickness and width (height) of a joist are usually established at a sawmill, and are not changed during construction. By contrast, the *length* of a joist is often altered at a construction site. A long wooden beam that will be used as a joist can be cut to any shorter length, using a saw, or two beams can be coupled together to make a longer joist, using various types of bolts and/or braces.

In any typical construction, joists are spaced apart from each other by relatively consistent distances. In most wood-framed homes built in the United States over the last few decades, typical spacing between adjacent joists is usually 16.5 inches, "center-to-center". This means that

the distance from an imaginary vertical "center-line" on one joist, to the imaginary "center-line" on the next joist, is about 16.5 inches. Because joists usually have thicknesses of about 1.5 to about 1.8 inches, the width of the unoccupied space, between two joists, usually ranges from about 14.7 to about 15 inches.

However, one of the key factors that underlies the design and utility of this invention needs to be clearly recognized: the horizontal spacing between adjacent joists is not always consistent and uniform. Instead, it often varies, by up to about an inch in either direction (i.e., from about 15.5 inches, up to about 17.5 inches, measured center-to-center).

This arises from the fact that there is no need for precision, in the spacing between joists that will support a floor, so long as the spacing of those joists remains within a reasonable and acceptable range. Homes can be built faster, with no loss of strength, stability, or other advantages, by allowing carpenters to work within a range, when it comes to certain steps during the construction. Exact distances and measurements are much more critical in numerous other stages of construction, so those stages in a construction project receive closer attention and more care than the spacing of a set of joists beneath a floor.

The fact that adjacent joists generally have a range of spacings, rather than having exact and consistent spacings, has frustrated and stymied numerous efforts to create simple and convenient storage boxes that can be installed conveniently and reliably between joists, by average homeowners who do not receive special training in that type of installation. Instead, every effort to create and then commercialize such storage devices has apparently failed.

As evidence, no such devices are stocked or sold by any Home Depot, Lowe's, WalMart, Sears, or other stores that belongs to any national chain of stores that carry other types of storage devices. Even more revealingly, despite half an hour each of diligent searching of the Internet by both the Applicant, and by his patent attorney (in separate sessions), neither of them were able to locate even a single company that offer and sells, over the Internet, even a single type of storage device that is designed to be installed between joists in basement ceilings.

The absence of any such commercially-available storage devices is not due to a lack of interest or efforts. Instead, numerous inventors have invested substantial funds of their own, in developing and then obtaining patent protection for storage devices that are clearly and explicitly designed to be installed between joists, in basement ceilings. Examples include US patents

4,699,437 (Genereaux 1987), 5,039,902 (Schwarz 1991), and 5,649,751 (Longhurst 1997).

However, as noted above, it appears that none of those products is available, to prospective purchasers.

A careful analysis of those patents will lead to the following conclusion: none of the designs disclosed in any those prior art patents can adapt or lend itself, in a convenient and reliable manner, to the variations that commonly occur in the distances between adjacent joists. If all joists were reliably and consistently spaced exactly 16.5 inches apart (or within some small tolerance, such as within 1/8 or 1/4 inch of that distance), they would offer ideal structures for supporting storage boxes, because of their strength, stability, and out-of-the-way location. However, joists vary substantially in their spacing, and inventors prior to this Applicant have not been able to design storage boxes that could be mass-manufactured in ways that can accommodate the substantial variations that occur in spacings between adjacent joists.

It also should be recognized that the numbers and locations of well-suited spaces between joists, which could accommodate storage boxes as disclosed herein or in the prior art, varies widely between different houses, and generally comprises an unpredictable patchwork. This is because the vertical height that is occupied by joists, between a basement ceiling and a main-level floor, is also used to install and support: (1) heating and air-conditioning ducts, which include supply ducts that carry air away from a furnace or a central air-conditioning unit, as well as return ducts that carry air back to the central unit(s); (2) plumbing, which must includes pressurized supply pipes that often span the entire width or length of a basement, as well as unpressurized drainage pipes that usually are oriented more vertically; and, (3) electrical wires, which include power lines (usually 110 to 120 volt) as well as signal lines (for telephones, televisions, computers, intercoms, doorbells, etc.).

Because the locations of the ducts, pipes, and wires within a basement ceiling varies widely between different houses, a basement ceiling typically will contain an irregular and unpredictable patchwork of unoccupied joist spaces that might be useful for storage, at various locations that do not happen to be occupied or traversed by ducts, plumbing, or wires.

In so-called "unfinished" basements, no effort is made to conceal the overhead joists (or the ducts, plumbing, or wires) from view. Accordingly, the unoccupied and available spaces between joists can be easily identified.

In most "finished" basements, a type of ceiling structure known as a "drop ceiling" is usually installed. This type of structure includes a lightweight metallic or hard-plastic frame, which is hung from the joists by means of stiff wires that are coupled to nails or screws, which are driven into the joists when the drop ceiling is installed. After this type of frame has been installed, it will then support square or rectangular panels, usually made of lightweight sound-absorbing material. These panels can be slid into the open spaces provided by the frame, and then positioned in a manner that allows them to rest on horizontal rails that are provided by the frame.

Most builders and homeowners prefer drop ceilings, in basements, rather than "fixed ceiling" (i.e., nailed, taped, and sealed) construction of the type that is normally used in the main floors of a home. At least two major advantages are provided by drop ceilings: (1) they allow convenient access to ducts, plumbing, and wires, thereby allowing easier maintenance, repair, and replacement, as well as easier improvements and enhancements to a home; (2) they make it much easier for homeowners and others to respond effectively to water leaks, hidden unpleasant odors, invasions by mice, insects, or other pests, and various other problems.

Accordingly, drop ceilings are generally preferred, in most homes with finished basements. By moving and sliding around the lightweight panels that are supported by the frame, a drop ceiling can allow reasonably convenient access to unoccupied spaces between adjacent joists.

Alternately, in homes having unfinished basements, the joists are openly visible. This can allow even simpler and easier access to any storage boxes that are mounted in one or more unoccupied spaces between joists.

Therefore, the spaces between joists, in a basement, offer good options for providing storage space that will not take up any floor space, and that will not aggravate a cluttered and crowded look in a room. In addition, this type of overhead storage can be used to place potentially hazardous, fragile, or valuable items out of the reach of small children, as well as to provide unnoticed and out-of-the-way storage for private personal items (such as personal financial documents, unused checkbooks or credit cards, letters from past romances, computer discs with copies of important files, etc.).

However, as mentioned above, any such storage devices, in order to be suited for mass-manufacturing and mass-marketing, must provide some means for adapting to and

accommodating the substantial variations in spacings that occur, between adjacent joists, in most homes.

For purposes of describing the invention herein, it is presumed that any joists described in the text or depicted in any drawings are located in a basement ceiling, and support a flooring layer that forms part of main floor of a home (which includes the kitchen, living room, etc.). However, this is merely exemplary, to simplify the discussion of the storage devices disclosed herein. Unless specific factors indicate otherwise in a particular building, any joists that are accessible to a homeowner (or to a renter, landlord, etc.) may provide unoccupied spaces, between adjacent joists, that may be adaptable to hold storage devices as disclosed herein.

In a similar manner, any comments herein referring to homes or houses are merely exemplary, for purposes of illustration rather than limitation. As examples, multi-story buildings (including high-rise apartments, office buildings, etc.) usually contain ceiling-and-floor structures with spaced joists that are hidden by drop ceilings. Spaced joists offer the most efficient and economical way to both (i) support the weight of the floors, furniture, and occupants in a multi-story building, and (ii) allow air-handling ducts, plumbing, and wiring to be installed in locations that will serve all of the floors and rooms in the building. Similarly, drop ceilings with movable ceiling panels offer a convenient way for maintenance workers to service or modify the ducts, pipes, and wires. Most high-rise buildings have accessible joists, although they are usually made of steel, aluminum, or other non-wood materials, to reduce the risk of fire or smoke. Accordingly, any such joists that are accessible, in any such building, are likely to provide a number of unoccupied spaces, in which joist-mounted storage devices as disclosed herein can be installed.

Therefore, one object of this invention is to provide a storage device that can be mass-manufactured, and that can be easily installed into spaces between adjacent joists, in a manner that can allow convenient and reliable installation, by untrained homeowners, between two adjacent joists that may vary substantially in their actual spacing.

Another object of this invention is to provide a storage device that can be mass-manufactured, and that can be easily and reliably installed, by an untrained homeowner, into an unoccupied space between two adjacent joists, even though the spacing between the joists may vary from about 15.5 to about 17.5 inches, measured center-to-center.

Another object of this invention is to disclose a mounting system that is adapted for use in securely affixing storage devices to ceiling joists, and that can be mass-manufactured with exact sizes, to provide an installation kit that is designed to accommodate substantial variations in joist spacings.

Another object of this invention is to disclose a storage system designed for mounting between ceiling joists, in a manner that can be easily, conveniently, and reliably installed by untrained homeowners between adjacent ceiling joists, regardless of the exact distance between two adjacent joists.

Another object of this invention is to disclose a storage device designed for mounting between ceiling joists, in a manner that allows safe and reliable loading and unloading of the storage device, by a person who does not have a high degree of arm strength, with minimal risk of slippage, falling, or other unwanted incidents that might damage the box or any items being loaded into the box or removed from the box, or that might injure a person loading the box, or a helper, child, or anyone else who is in the vicinity while the device is being loaded or unloaded.

Another object of this invention is to disclose a storage device for storing bulky objects (such as tents, sleeping bags, etc.) and/or elongated objects (such as skis, rifles, etc.) between ceiling joists, without providing or requiring a container to enclose the items.

Another object of this invention is to disclose devices to allow hidden yet accessible storage between ceiling joists, in a manner that provides increased security (by means of concealment) for the stored items, against theft.

These and other objects of the invention will become more apparent through the following summary, drawings, and detailed description.

SUMMARY OF THE INVENTION

Storage devices are disclosed that allow convenient and reliable installation in a space between two joists, such as in a basement ceiling, despite the substantial variations that commonly occur in joist spacings. This is accomplished by mounting a storage enclosure, such as a box with a lid that can be sealed or latched, on top of a supporting shelf having rails along two opposed edges (such as a wire shelf, of the type that can be purchased in any large hardware store). Two or more support brackets having a first design that provides a slidable surface

(referred to herein as L-brackets) are mounted to the bottom of one joist, and will support a first rail along one side of the shelf. These L-brackets will allow the first rail to slide horizontally a substantial distance, to accommodate common variations in joist spacings. Two or more support brackets having a second design that provides a concave surface (such as J-shaped hooks) are mounted to the bottom of an adjacent joist, in a manner that allow them to support a second rail on the opposite side of the shelf.

To lower the shelf from an in-use storage position, the second rail is lifted slightly, to lift it off the J-hooks. The shelf is slid toward the other joist, causing the first rail to slide along the horizontal supporting surfaces of the L-brackets. The shelf is then lowered, causing it to rotate downward while the first rail functions as a supported axle. Constraining devices (such as lips on the edges of the L-brackets) prevent the shelf and box from falling; however, the shelf can be fully disengaged from the L-brackets, when desired, for loading or unloading.

In one embodiment, a storage compartment such as a box with a lid is affixed to the shelf, for storing small items that will be protected within the box, which may be lockable. An alternate embodiment provides a shelf with bungee cords or similar devices, for storing items that are bulky (such as tents, sleeping bags, seasonal items, etc.) or elongated (such as skis, rifles, etc.).

A third embodiment uses modified L-brackets and J-hooks to provide both upper and lower supporting levels. The upper supports can support a storage shelf, with or without a storage compartment on top of it. The lower supports can support a lightweight ceiling panel, which can be lowered and raised easily and conveniently, in the same manner as the shelf.

These storage devices can allow visual inspection of any stored items, by using a wire supporting shelf, and by using wire or clear plastic to make the bottom surface of any box or other enclosure. Alternately, the presence and location of these storage devices can be completely hidden, above a drop ceiling, for security against theft or tampering.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a depiction of a support shelf with a storage box resting on it, mounted between two joists shown in cross-section, showing an L-bracket on the left joist, and a J-hook on the right joist.

FIGURE 2 depicts an L-bracket in greater detail, showing a shoulder component that

allows the bracket to be easily affixed to the joist at a proper height.

FIGURE 3 depicts a J-hook in greater detail.

FIGURE 4 is a perspective view of an L-bracket with an edge rod (or rail) of a wire shelf resting on it, with the bracket positioned between two spaced wires of the shelf.

FIGURE 5 depicts a shelf-and-box assembly being lowered from its storage position, to indicate how the size and "setback" placement of the box allow it to travel through an arc of motion during placement or retrieval.

FIGURE 6 depicts a shelf-and-box unit that has been lifted off the L-brackets, thereby fully disengaging it from the joists and brackets so it can be set on a table, floor, or other surface for loading or unloading.

FIGURE 7 depicts a modified set of L-brackets and J-hooks that are mounted above the bottom surfaces of two adjacent joists, for increased security against theft or tampering, and for use with drop ceilings that have minimal clearance between the joist bottoms and the suspended panels.

FIGURE 8 depicts modified L-brackets and J-hooks that provide additional supporting surfaces, to support both a storage shelf, and a ceiling panel that can be easily raised or lowered, to allow convenient access to the stored items. FIG. 7 also depicts a shelf with a bulky item that will not fit in a box, resting on the shelf and secured by a bungee cord.

DETAILED DESCRIPTION

As summarized above, FIG. 1 depicts a storage device 100, comprising a support shelf 200 which rests on support brackets 110 and 120 (which can also be referred to as mounting brackets), and a storage compartment (such as box 300) that rests on support shelf 200. Box 300 is positioned in the open space between two adjacent joists 82 and 84 (shown in cross-section), which help support flooring or subflooring layer 86 (also shown in cross-section).

As illustrated on the left side of FIGS. 1, 5, and 6, a first type of supporting bracket is designed to provide a "traversable" supporting surface (i.e., a supporting surface upon which a rail can rest, and which is designed to allow a rail to be slid, rolled, or otherwise moved across a limited distance of the supporting surface without major hindrance). In the simplest and most convenient embodiment, the traversable surface is simply an essentially flat, horizontal, and

smooth surface that will allow a metallic or other hard component to be slid across it, and which therefore can be referred to as a *slidable surface*.

The type of first mounting bracket that is illustrated in the drawings is referred to herein as an L-bracket 110, since this preferred embodiment has a cross-sectional shape that is similar to the letter "L". As shown in greater detail in FIG. 2, L-bracket 110 comprises at least one vertical segment 114, a portion of which will rest against one vertical face of joist 82, and a horizontal segment 116, which preferably should be installed in an essentially horizontal orientation and which will provide traversable surface 117. Traversable surface 117 will not press against the lower surface of joist 82; instead, a "clearance" gap will be provided between traversable surface 117 and joist 82, in a manner that will allow edge rail 202 of wire shelf 200 to slide across the traversable surface 117.

The first supporting brackets should also be designed in a manner that provides a constraining component that will effectively prevent the shelf 200 from inadvertently falling off of the first brackets, unless an operator intentionally disengages the shelf from the brackets. In a simple and preferred embodiment that is adequate for most types of lightweight storage, this constraining component can be provided by a simple "lip" structure 119 positioned at or near the outer edge of horizontal segment 116. More elaborate constraining components are known, and can be selected for heavier storage devices, if desired, to provide a higher level of safety.

Vertical segment 114 of L-bracket 110 can be made of a stiff plastic (such as nylon, graphite, etc.) or metal (such as extruded aluminum), and should provide at least one means for securely affixing it to a wooden joist (such as a mounting hole for a conventional threaded screw 112, as shown in FIGS 2 and 4). Brackets designed to hold substantially heavier loads, and/or to provide greater security against tampering or theft, can use any of various other securing means. For example, a round-headed carriage bolt can pass through a hole that has been drilled through the joist, and can be secured by a threaded nut on the other side of the joist. This will prevent the carriage bolt from being removed, unless a shelf with a locking mechanism has been unlocked and opened.

As shown in FIG. 2, vertical segment 114 of L-bracket 110 can also provide a "shoulder" surface 115, which will be positioned against a lower corner of joist 82. This can make it easier for a homeowner to install the L-bracket 110 at exactly the right height on joist 82, in a manner

that provides a proper clearance gap between the bottom of the joist, and the horizontal surface 116 and lip structure 119 of L-bracket 110.

As mentioned above, a second set of support brackets 120 is also used. One of its essential characteristics is that it allows a "second edge rail" of the support shelf to be disengaged from the second support brackets, while the "first edge rail" of the shelf (on the opposite side of the shelf) remains supported by the "first" support brackets that provide a slidable surface.

The dimension of the shelves shown in the drawings is referred to as the width of the shelf, and will be determined by the distance between adjacent building joists. The other horizontal dimension is referred to as the length of the shelf, and can vary substantially, from about 15 inches long, up to about 10 feet long (although most such shelves usually will not exceed about 4 feet, for safety and convenience). To avoid potential confusion over which term refers to which dimension, the two rails 202 and 204 of shelf 200 are referred to herein as "edge rails" rather than "side rails"; however, either term can be used, if desired, and those rails can also be referred to as rods or similar terms, if desired.

One preferred embodiment of the second support brackets is referred to herein as a "J-hook", as suggested by its shape, which is shown in greater detail in FIG. 3. This bracket comprises: (i) a vertical segment 121, which presses against the vertical surface of the joist 84, and which provides at least one hole for a screw 122 or other mounting means; (ii) a support segment 124, which provides a rounded concave resting surface 126, which will cause the edge of a wire shelf to settle securely into the lowest point at the center of the resting surface 126; and, (iii) a backside protrusion 128, which will make it easy for a homeowner to install the bracket at exactly the right height, on the bottom of a joist.

It should be noted that brackets having various other shapes can be used instead of J-hooks, if desired. As one example, the rail-supporting surface of a second bracket could have an angled rather than rounded rail-support surface, and could be referred to as a V-hook; alternately, an additional set of L-brackets that are identical copies of the first supporting brackets could be used, if desired. However, J-hooks are preferred, since they provide a combination of strength, stability, and lack of motion that will provide a homeowner or other user with a more reassuring and comfortable "feel" when a storage box (especially one that is fairly heavy, when fully loaded) has fully settled into its resting position.

Wire shelf 200, which has a first edge rail 202 on one side and a second edge rail 204 on its opposing side, is positioned (during storage) such that first edge rail 202 rests on at least two L-brackets 110 that are spaced apart from each other on joist 82, and second edge rail 204 rests on two J-hooks 120 that are spaced apart from each other on joist 84. At least two support brackets preferably should be placed on each joist, for greater support, stability, and safety. For relatively lightweight storage, placement of four brackets, proximate to each of the corners of a rectangular shelf, will be sufficient. To evenly distribute any loads and to minimize stresses on the shelf, these brackets should be positioned, not at the far ends of the shelf, but partway toward the center of the shelf, so that about 60% of the shelf length will be located between the two pairs of supporting brackets, while the remaining 40% of the shelf length will be located outside the support brackets. For heavier storage, additional support brackets can be mounted on either or preferably both joists, using larger screws, bolts, or other suitably strong mounting means.

Rails 202 and 204 can be referred to as "rods", because they are normally circular in most types of wire shelves. However, the broader term "rail" is used herein, since "rod" tends to imply a circular cross-section, while a rail can have any desired cross-sectional shape. Circular rods are generally preferred, but not essential, for providing the two edge rails that will rest on the L-brackets and J-hooks.

Both types of mounting brackets have open tops, thereby allowing shelf 200 (and box 300) to be disengaged first from J-hook 120, and then from L-bracket 110. This will allow an owner or other person to lower the shelf (with the box attached) and place it on a table, desk, floor, or other surface for unhindered loading, unloading, or other activities or access.

The main (lower) component of the storage compartment is exemplified herein by box 300. A generally rectangular shape (in the plan view, as well as in both vertical cross-sections) is not essential, but will be preferred for most uses, since it can provide the greatest amount of enclosed storage space within a rectangular volume between two adjacent joists.

After shelf 200 and box 300 have been lowered and placed on a desk, table, floor, or other surface, access into box 300 can be provided by any suitable means, such as an open top (as shown) or an open end. If an open top is provided, it can be covered and closed (during storage) by lid 310. If an open end is provided, it can be covered and closed by an end cap, one or more securing straps, etc. If desired, the main (lower) component of box 300 can be referred to by

terms that will clearly distinguish it from the lid component 310; such terms include body, tray (which implies an open top), or pan (which is not preferred, since it tends to imply a shallow lower component).

Lid 310 can be affixed to box 300 by means such as hinge 312, positioned along one edge of box 300, as shown in FIG. 1. The hinge(s) can be of any conventional type (such as a thin strip of molded plastic, metallic hinges with rotatable axles, plastic moldings with protruding pins that can be snap-fit into accommodating cylinders or depressions, etc.). Alternately, a molded plastic box can be used with a detachable molded plastic "snap-on" lid.

Various types of relatively lightweight materials can be used to manufacture boxes suitable for use as disclosed herein. Boxes for holding everyday items that do not have great value (such as toys, games, non-seasonal clothing, hazardous items that are being kept away from small children, etc.) can be made of molded plastic that can be transparent or translucent, to allow visual inspection of any stored items, by a person standing below the box. Boxes for holding more valuable items can be made of steel or other sheet metal, and can be secured with locks.

If a support shelf made of sufficiently strong material is used, and if strong mounting brackets are affixed to the joists by means such as lag screws or bolts, the box can be made of substantially heavier material, up to and including (for example) a fire-resistant safe that is small enough to fit between adjacent joists. If this type of strong and heavy enclosure is used, lid 312 can be replaced by a lockable door. When the enclosure is lowered down from J-hooks 120 but continues to hang from the L-brackets (if desired, the L-brackets can be provided with a shallow depression near their strong corner, so that shelf rail 202 will settle into that accommodating depression while the heavy enclosure remains suspended from it), the lockable door will be vertical, allowing it to act as a door that allows access into the device, which will be hanging at roughly eye level. Preferably, an enclosure designed to function in that manner should be provided with slanted shelves or other internal components that can prevent any contents from spilling out, when the door is opened. In general, joists are designed to withstand hundreds or even thousands of pounds of vertical loading, as evidenced by the fact that a typical room can easily and safely hold more than 20 people. Nevertheless, installation of a small safe or other heavy enclosure, between two joists, usually should be done as close as possible to an outer wall

or other strong vertical support, to minimize certain types of forces called "bending moments", which can stress, distort, and damage long horizontal supports.

Since conventional building joists can support very heavy weights, it is entirely reasonable and practical for a storage system as disclosed herein to be designed to hold heavy loads that are limited, on a practical level, only by the ability of average homeowners or apartment dwellers to safely and conveniently raise and lower the storage units. Accordingly, storage units that can support weights of up to about 200 pounds are entirely feasible and practical herein, given the fact that only half of that weight (or even less, depending on placement) will need to be lifted by a user in order to disengage one of the side rails from the J-hooks. Since two conventional and inexpensive steel bolts mounted in a single joist, using moderately thick steel mounting brackets, can support weights that will be several multiples of the upper limit that is practical for human lifting, a storage system as disclosed herein that can support 200 pounds or more is entirely feasible and realistic, and would not be highly expensive. In general, any system that is designed to weigh more than 100 pounds when fully loaded should be designed with a presumption that the storage unit may never be lowered from the L-brackets, after it has been placed on them, and instead will be loaded and unloaded while it remains suspended vertically from the L-brackets.

If desired, box 300 can be affixed to shelf 200, to prevent the box from sliding across the surface of shelf 200 as the shelf is being tilted and lowered, as illustrated in FIGS. 4 and 5. Box 300 can be affixed to shelf 200 by any of several means, such as: (i) providing the bottom surface of box 300 with one or more clip-type devices that will engage either an edge rail or a center rod in a wire shelf; (ii) providing the bottom of a box with one or more threaded, bayonet-type, or other receptacles that can receive a threaded screw, shaft with protruding pins, or other securing device that can be passed between adjacent spaced wires in a wire shelf; or, (iii) using duct tape or other adhesive material to secure the box to the wire shelf, after it has been confirmed that the box is appropriately positioned on the shelf and everything fits properly between the joists.

It also should be noted that placing box 300 in the center of shelf 200, in Figures 1,4, and 5, is done solely for purposes of illustration. With some boxes, it will be preferable to place the box closer to the edge rail 202 that will rest on the L-brackets 110. This will allow a somewhat larger box (which can hold more items) to travel through the raising and lowering arc shown in

FIGS. 4 and 5, without jamming against J-hook 120.

Alternately, box 300 can simply rest on top of shelf 200, and can slide across the upper surface of the shelf. This can allow box 300 to be removed from shelf 200 in either of two manners. First, if sufficient "clearance" room is available beyond either or both ends of the shelf, box 300 can simply be slid off of one end of the shelf (i.e., in the same direction as the lengths of the joists), while the shelf remains stationary and secure on its mounting brackets. While on this subject, it also should be noted that two or more boxes can be stored on a single shelf, if the shelf is long enough to support the boxes.

If box 300 is not affixed to shelf 200, then box 300 will slide in a downward direction as the shelf 200 is tilted downward, as shown in FIGS. 4 and 5. However, if box 300 is not heavy, it can be easily prevented from falling off of shelf 200, with assistance from a lip 220 (also called a rim, edge, or similar terms) that forms part of the edge of shelf 200, as shown in FIGS. 4 and 5. Such lip portions are provided on most wire shelves that are sold for home, apartment, or commercial uses, since they are highly convenient and also help reinforce a shelf and make it substantially more resistant to bending.

It should be noted that in most types of wire shelves sold for home or apartment use, the lip of the shelf points downward, and is for strength and reinforcement only, and does not prevent things from being slid off of the shelf. Therefore, in most wire shelves sold for home or apartment use, the edge lip and the center supporting rod are on the same side of the shelf. However, this arrangement would interfere with proper use of a shelf in a storage device as disclosed herein, since a center supporting rod resting on top of the spaced wires of a wire shelf would prevent a storage box from resting in a stable and secure manner on the spaced wires. Therefore, if a center reinforcing rod is provided on a shelf having an upward lip, as described herein, the center reinforcing rod preferably should be affixed to the bottoms of the spaced wires.

The size of a storage box must take into account the size of typical joist spaces. The horizontal distance between two joists will almost always be at least about 14 inches, in the United States (construction dimensions in other countries may vary), and that width is usually closer to about 15 inches. Therefore, a rectangular box that is about 11 to 12 inches wide, at its base, generally will be able to fit into a joist space, with allowances for the necessary raising and lowering motions depicted in FIGS. 4 and 5. The maximum allowable width of a box that will fit

into a typical joist space will also depend on the height (depth) of the box.

It also should be noted that if a box is provided with a "front" wall 320 (i.e., the wall that will be positioned close to J-hooks 120) that slopes or is rounded toward the back of the box, then a slightly larger box with a wider base can be used.

In view of these factors, boxes having widths (i.e., the dimension that spans the gap between two joists) that range from about 10 to about 12 inches are generally preferred. Lengths are more variable, since open spaces between adjacent joists often extend for 10 feet or more in many buildings. In general, to make it easier to handle the boxes, lengths in a range of about 15 to about 40 inches will be preferred for most uses, but shorter or longer boxes can be manufactured and used if desired.

The preferred height (or depth, referring to the dimension that is vertical when a box is resting on a shelf as shown in FIG. 1) for a box will depend on the height of the joist space that the box will occupy. In one preferred approach, a homeowner, landlord, or other person who wants to purchase this type of storage unit will be asked to: (i) measure the joists in his/her building, to determine whether those particular joists are made of (for example) 2x6, 2x8, or 2x10 lumber; and, (ii) look at the bottom surface of the flooring layer, in the intended spot, to determine whether any nails or other items extend downwardly a substantial distance into the joist space. A person who knows that information can then purchase a storage box having the maximum height that will fit within that particular joist space, from an assortment of available boxes having (for example) total exterior heights of about 5, 7, or 9 inches.

It should also be recognized that the shelves and brackets disclosed herein can also be highly useful, without requiring a box or other sealable enclosure to be placed on top of the shelf. As an illustration, FIG. 8 depicts the same type of shelf device 200, without a box on top of it, suspended from L-brackets and J-hooks in the manner as described above. This configuration can allow people to store items on the shelves, which will not fit within a box. Such items might include, for example, a tent or sleeping bag 502 (as shown in FIG. 8), puzzles or games that are contained in their own boxes, and other bulky items; such items may also include items (such as skis, rifles, leftover lumber that might be useful some day, etc.) that are too long to fit in plastic boxes less than 3 feet long. Such items can be secured to a supporting shelf 200 (or, if desired, to more than one shelf, lined up in a single joist space) by means such as stretchable cords 504 with

hooks 506 (these can be conventional "bungee" or "bunjee" cords), or by tying the items directly to shelf 200 with cord, twine, rope, etc.

WIRE SHELVES

The storage systems disclosed herein are designed to work properly with nearly any type of conventional "wire shelves". Because wire shelves are lighter, stronger, easier to handle, and more durable than comparable-sized wooden shelves, and because wire shelves allow easier visual inspection of items stacked on top of them, wire shelves are widely used and readily available at any large hardware store. They also are sold over the Internet; numerous supplier companies and photographic illustrations can be located by searching any Internet search engine for "wire shelves".

In general, nearly any type of wire shelf is made of two principle types of components, referred to herein as "supporting rods" (which can include edge rails as well as a center rod) and "spaced wires". These are exemplified by edge rail 202 and 204 (which rest on support brackets 110 and 120, respectively, in the storage unit depicted in FIGS. 1, 5, and 6), and by spaced wires 210, illustrated in FIG. 4.

Most types of wire shelves sold for home or apartment use also have a center rod, as well as a "lip" structure on one edge, as illustrated by "lip rod" 206, in FIG. 5. These components provide additional strength and stiffness.

In most wire shelves sold for home or apartment use, the supporting rods typically are about 1/4 inch in diameter, while the spaced wires typically are about 1/8 inch (or slightly less) in diameter, with 1 inch (center-to-center) spacing. Shelves made of rods and wires having these thicknesses and strengths will be more than adequate for most types of overhead storage as disclosed herein, and since they are already being mass-manufactured, the costs of such units can be kept to a minimum. For storing heavier items, wire shelves made of thicker and stronger rods and wires (these also are currently available, for commercial or industrial use) can be used. These preferably should be supported by larger and stronger supporting brackets, which should be held up by at least two mounting screws each, or by bolts that pass through holes that are drilled through the joists.

Since the spacing between any two adjacent spaced wires (in a standard wire shelf for

home or apartment use) is about 7/8 inch, these types of wire shelves are well-suited for accommodating brackets that have thicknesses up to about 5/8 inch, and mounting brackets made of nylon or other stiff plastic having widths of about 1/2 inch can provide sufficient strength for most types of home storage, since four different brackets will share and distribute a load that in most cases will never exceed about 40 pounds. A first L-bracket can be screwed to a joist at any desired general location, and a second L-bracket can be installed any chosen number of inches away from it, along the same joist. If the center-to-center spacing of the two L-brackets is within about 1/4 inch (in tolerance) of being an integral number of inches, both of the brackets will fit between spaced wires in the shelf. Alternately, after a first L-bracket has been installed on a joist, the installer can hold up a wire shelf, place one edge rod on the already-installed L-bracket, and mark a spot that is midway between two spaced wires near the other end of the shelf, to ensure proper placement of the second L-bracket.

The spaced wires 210 will have lengths that define and span the width of a wire shelf, and they will be attached (usually by spot-welding) to the edge rails 202 and 204 that establish the two edges of a shelf 200. In order to accommodate average joist spacings of 16.5 inches (center-to-center), a wire shelf for use in a joist-mounted storage device as disclosed herein should generally have a width of about 15 inches, depending on the exact dimensions of J-hook 120. This reflects the fact, as shown in various figures, that edge rail 204 will not be positioned beneath the center of joist 84; instead, rail 204 will rest in the lowest point in the concave support surface 126 of J-hook 120, which will be offset from the center of joist 84 by roughly 1.5 inches.

If desired, wire shelf 200 can also comprise a lip-type edge structure, established by an additional rail 206, with spaced wires 220 bent partially around edge rail 204, as shown in FIG. 5. This type of lip structure, if provided as part of the wire shelf 200, can be used to help reduce any risk that a storage box or other device might inadvertently fall off of shelf 200 as it is being lowered.

As can be seen in FIGS. 5 and 6, edge rail 202 will function as a slidable hinge or axle component. It will rest on horizontal surface of L-bracket 110, in a slidable manner; and, when the support shelf 200 is being placed upon or removed from the brackets 110 and 120, edge rail 202 will rotate, in a manner comparable to a hinge or axle.

As shown in FIG. 6, after storage device 100 has been rotated a sufficient amount to

allow edge rail 204 to move fully away from J-hook 120, edge rail 202 can be lifted off of the L-bracket 110. Edge rail 202 can then be completely disengaged from the L-bracket 110, by lifting it through the gap that exists between the lower edge of joist 82, and the top edge of the L-bracket lip structure 119. This will allow the entire shelf unit 200 and storage box 300 to be placed on any table, desk, floor, or other surface, for loading or unloading.

Wire shelves having lengths ranging from about 2 feet, up to about 8 feet, are commonly sold at hardware stores. Because of weight and ease-of-use factors, preferred lengths for shelves for most storage units generally will range from about 2 to slightly less than 4 feet, for basements having drop ceilings, since most drop ceilings use frames that accommodate panels that are 4 feet long.

In unfinished ceilings, and with drop ceilings that have frame cross-members that can be moved when desired and later replaced without difficulty, installation of longer storage units (such as up to about 8 feet long) is feasible, and may be useful for some homeowners, tenants, or others. However, because of their design and construction, it will render these units easier and safer to use if two or more support shelves, less than about 4 feet long each, are installed end-to-end, rather than installing a single very long shelf.

ANTI-THEFT OPTIONS

Consideration should be given to various enhancements that can be provided, and steps that can be taken, to reduce the risk of someone stealing or tampering with the contents of a storage device as disclosed herein.

As indicated previously, any storage devices that are completely hidden from view, by the opaque panels of a drop ceiling, will already be relatively secure against theft or tampering, due to the fact that they are hidden, and their presence and location will be unknown to anyone who did not install them and has not been told about them.

To further reduce the risk of detection and tampering, these storage devices can be deliberately placed in specific locations where line-of-sight detection will be difficult or impossible, even to a thief who might be standing on a chair and using a flashlight to look across the upper surface of a drop ceiling. For example, boxes that are placed next to air-handling ducts (especially "return" ducts, which usually are large and rectangular) will be difficult to see and

locate. Since most burglaries are carried out in haste to reduce the risk that the burglar will be caught before he can escape, these steps can reduce the risk that a storage box holding valuable items would be found by a thief.

To further reduce the risk of detection, at the expense of losing a small amount of height that is available for storage, slightly modified L-brackets and J-hooks can be used, to ensure that a support shelf and storage box are entirely out of sight to someone using a flashlight to look horizontally across the upper surface of a drop ceiling. Such modified L-brackets 402 and J-hooks 404, which cannot be seen from either side of the two joists 82 and 84, are illustrated in FIG. 7.

If still greater anti-theft and anti-tampering measures are desired, they can be provided by any of several means. As one example, a rotatable or slidable locking mechanism can be provided, to prevent edge rail 204 of shelf unit 200 from being lifted off of J-hook 120, by anyone who does not have the key or combination to the lock.

In addition, screw 112 (which is used to secure L-bracket 110) can be replaced by a round-head carriage bolt that will pass through a hole that will be drilled through joist 82. This carriage bolt would be secured by a threaded nut on the other side of the joist. Unless the shelf has already been disengaged, and lowered from the joist space, this would make it impossible for someone to reach the storage box by simply unscrewing an L-bracket 110 from joist 82. In addition, if anti-theft safeguards are being used, the shelf unit 200 generally should be provided with end walls at both ends of the shelf, to render it more difficult for a thief to reach the storage box.

Similarly, various types of electronic devices can be used to provide increased security, if desired. As one example, the act of lifting edge rail 204 from J-hook 120 can activate an electronic sensor, which can be wired or programmed to activate an alarm, turn on one or more small hidden video cameras, etc. Alternately, providing an obvious written warning that an alarm will be triggered, coupled with placement of wires that lead away from a visible trigger mechanism, can deter most people who might be curious to know what is in the box, even if the wires do not actually trigger an alarm system or video camera.

DOUBLE-BRACKETS FOR SUSPENDED CEILING PANELS

Some homeowners find it difficult to maneuver ceiling panels around in a drop ceiling, due to problems such as arthritis, allergies and eyes that are sensitive to any dust that might come down from the panels, etc. In addition, nearly any drop ceiling will have a substantial number of panels that are difficult to maneuver, due to inadequate clearance between the panels and the joists, and/or to travel paths that are blocked or entangled by the hanger wires that are used to suspend the ceiling frame, or by other wires, pipes, lighting fixtures, and air ducts.

Accordingly, many homeowners would be more likely to purchase and use joist-mounted storage devices as disclosed herein, if these devices will also provide means for making it easier and more convenient to raise or lower a ceiling panel that rests directly below the storage device.

This can be accomplished in any of several ways, including the approach illustrated in FIG. 8. This system illustrates modified L-brackets 610, and modified J-hooks 620, each of which provide support for both (i) a support shelf 200, as described previously, and (ii) a ceiling panel 630.

The support shelf 200 in this embodiment will be installed and handled in exactly the same manner as described above, using "shelf arm" 612 of L-bracket 610, and "shelf hook" 622 of J-hook 620. As with any such storage device, shelf 200 will be accessible only if the panel of a drop ceiling (if one is present) has been moved out of the way.

In addition to shelf arm 612, L-bracket 610 also has an external "panel arm" 614, positioned outside of the joist space. Panel arm 614 is designed to interact with a panel rail 640, which is coupled to ceiling panel 630 by means of a several molded plastic struts 642, which are affixed to a continuous molded plastic strip 644. Strip 644 can be securely affixed to an upper surface of a ceiling panel (using exactly the same type of ceiling panel that was used to make the remainder of the drop ceiling), by means of a strong adhesive that extends across the entire length of strip 644.

Similarly, J-hook 620 also has a "panel hook" 624, which will be positioned outside of the joist space. Panel hook 624 will support panel rail 650, which is coupled to ceiling panel 630 by means of struts 652 and adhesive strip 654.

It should be recognized that, by gluing the "strut strips" at appropriate locations on top of a ceiling panel, this design can accommodate ceiling panels having nearly any desired size. It

also should be recognized that, since the "panel arm" 614 of L-bracket 610 provides a slidable horizontal distance over which the panel rail 640 can slide, proper placement of the strut strips 644 and 654 will not require great precision.

FIG. 8 also depicts two "false frame" members, 660 and 662, which have been affixed to the outer edges of ceiling panel 630. These devices are designed to mimic the external appearance of a drop ceiling frame, in order to effectively conceal the presence of a storage device above ceiling panel 630. The structure of false frame members 660 and 662 is also designed in a way that will allow them to slide a significant distance, while properly engaging and supporting both of the two ceiling panels that flank the modified and concealing ceiling panel 630.

Accordingly, if this system is properly installed, it can provide simple and convenient means for easily raising and lower ceiling panels that are positioned directly beneath storage devices as disclosed herein. This advantage can be provided, regardless of whether any steps are taken to conceal the existence or placement of a storage device above one particular ceiling panel. However, if desired, steps also can be taken to ensure that a ceiling panel that can be easily lowered or raised will not look different from any other ceiling panels, and instead will appear to be just another panel in an array of multiple and apparently identical panels.

It should be understood that proper installation of a storage device that is concealed by a ceiling panel that is deliberately designed and intended to fit perfectly into an array of ceiling panels, with no visible clues to disclose the existence or location of the unusual panel, will require a greater level of skill and experience, than installation of a simpler system as shown in FIGS. 1 through 7. Accordingly, this type of installation can be done by trained installers, if desired. However, the difficulty of the tasks involved are generally no greater than the difficulty of installing, aligning, and properly adjusting the opening and closing force of a garage door opener. Therefore, homeowners who are accustomed to tackling such chores may wish to do it themselves, and they can do so, if an installation kit with all necessary components is supplemented with an adequate instruction manual and/or training video.

INSTALLATION

The installation of the basic storage devices disclosed herein (e.g., shelf-and-box units,

that do not also include suspended ceiling panels as shown in FIG. 8) will not be difficult. In general, simple written instructions, accompanied by line-drawing illustrations, will put it easily within the skills of nearly any homeowner, without requiring any special training or instruction videos.

In general, a purchaser or installer will be instructed to determine the general location of the storage unit, and to install a first L-bracket, on one joist, at a location that will be near one end of the shelf. Since most wire shelves of the types that are installed in home or apartment closets have center-to-center spacings of exactly 1 inch, between adjacent spaced wires, this will simplify the installation of subsequent L-brackets. After the first L-bracket has been screwed to the joist, the proper spacings for any and all additional L-brackets can be determined simply and easily, by using a measuring tape or stick to mark the positions for all subsequent L-brackets, an exact number of inches away from the already-affixed L-bracket.

Similarly, after two or more L-brackets have been screwed or otherwise securely affixed to one joist, it will be easy and convenient to determine the correct positions for J-hooks that will be mounted on an adjacent joist. This can be done by swinging the wire shelf up to the second joist, while the first rail of the wire shelf rests on the two L-brackets, and then placing a vertical mark on the joist, at a location that is midway between two spaced wires of the wire shelf.

Proper placement of the mounting brackets will not be difficult or highly sensitive, if the brackets have widths (thicknesses) that are appropriately narrower than the spacings between the spaced wires in a wire shelf. As mentioned above, most wire shelves designed for conventional closets have conventional spacing of 1 inch, center-to-center, and the thickness of the wires is usually slightly less than 1/8 inch. Therefore, the open slots between adjacent wires in these shelves is slightly more than 7/8 inch. Accordingly, support brackets having thicknesses of 1/2 inch can provide ample shear strength, with a good margin of safety, for loads up to 50 pounds, if a strong plastic such as nylon is used. If support brackets with those thicknesses are used, they will have ample room to fit into open slots between adjacent wires, with nearly 1/2 inch of free space remaining.

Installation of storage devices that also allow ceiling panels to be suspended from the same mounting brackets will be somewhat more difficult, and will rank somewhere in the same magnitude as installing a garage door opener. Accordingly, some homeowners will prefer to do it

themselves, while others will prefer to hire a carpenter, handyman, or other installer who has already done that type of work before and knows how to do it properly, to ensure a final result that looks clean and professional. If desired, training videos and/or instructional sessions (of the type that are offered on weekends by many large hardware stores) can be provided for anyone who wishes to learn how to do that type of installation.

Finally, it will be quickly recognized by those skilled in the art that various more elaborate and complex types of mounting brackets or shelf components can be created, if desired. As one example, rather than having a shelf rod simply rest upon and slide across a smooth and flat slidable surface of a support bracket, more elaborate engagement and traversal mechanisms (such as devices that provide ball-bearings, lubrication, TEFILON™ sliding surfaces, etc.) can be provided. Similarly, instead of using a wire shelf, it is possible to provide a shelf comprising a plastic, metal, or other solid panel that has one or more rails attached to two opposing sides of the panel; alternately, a shelf can be provided, if desired, by affixing tension-bearing members (such as flexible straps or ropes, rather than stiff wires) across a supporting frame, in one or more directions. Such elaborations typically will increase the cost of the unit. Accordingly, while they can be provided and used if desired, and while they may be preferable for heavier storage devices that provide locking means and additional security, they will not be necessary or preferred for most installations.

Thus, there has been shown and described a new and useful type of useful and convenient storage device that can be mounted between building joists. Although this invention has been exemplified for purposes of illustration and description by reference to certain specific embodiments, it will be apparent to those skilled in the art that various modifications, alterations, and equivalents of the illustrated examples are possible. Any such changes which derive directly from the teachings herein, and which do not depart from the spirit and scope of the invention, are deemed to be covered by this invention.

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